

REMARKS

Claims 1-4, 7 and 13-18 are presently pending in this application. Claims 1-4, 7, and 13 have been amended to more particularly define the invention. Claims 14-18 have been added to claim additional features of the invention. Claim 6 has been cancelled in the interest of expediting prosecution. Claims 8-12 were previously cancelled.

Objection was made to claim 13, with the contention that the claim is in improper dependent form for failing to further limit the subject matter of a previous claim.

Claims 6-7 were rejected under 35 U.S.C. §102(e) as being anticipated by Henson, et al., U.S. Patent No. 5,325,455. Claims 1-2 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kropp, U.S. Patent No. 6,227,722 B1, in view of Bruce, et al., U.S. Patent No. 6,312,581 B1 and Henson, et al. Claims 3 and 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kropp, in view of Bruce, et al. and Henson, et al., and further view of Kawaguchi, et al., U.S. Patent No. 6,361,222 B1.

This objection and these rejections are respectfully traversed.

THE OBJECTION TO CLAIM 13

The Office Action contends that claim 13 fails to further limit the subject matter of a previous claim. The Office Action then states that except for different wording, claims 2 and 13 are duplicated claims covering the same thing. It is unclear whether the Office Action is making one objection or two.

Claim 13 is dependent from claim 1, and so further limits claim 1. Thus, any objection that claim 13 fails to further limit the subject matter of a previous claim is clearly

incorrect.

Both before and after the above amendments, claim 13 specified an optical element mounted on the waveguide substrate and optically connected to the optical waveguide. This is illustrated in Figure 3 of the drawings in which semiconductor laser 21 is mounted on waveguide substrate 1 and optically connected to optical waveguide 4. See the specification at page 12, lines 19-20. (Note the correction made in the Amendment of January 15, 2004 in which reference numeral 12 in line 19 was corrected to 21.) Both before and after the above amendments, claim 2 specified an optical element mounted on and connected to the optical waveguide. This is illustrated in Figure 4 of the drawings in which semiconductor laser 21 is mounted on and optically connected to Si sub-mount 31. See the specification at page 13, lines 11-14. (Note the above amendment to line 14.)

It is accordingly submitted that claims 2 and 13 are of different scope, and so the objection should be withdrawn.

THE CLAIMED INVENTION

In an exemplary embodiment, the claimed invention is directed to an optical module which includes an elongated optical waveguide 4 (all reference numerals herein being for the Examiner's convenience, and not for limiting the claims), an optical waveguide substrate 1 on which the optical waveguide is mounted, and an optical fiber connecting end member 2 with a hole 13 through it for accommodating and fixing an end surface of the optical waveguide substrate. The hole 13 goes through the end member 2, and so has a top surface, a bottom surface, a first side surface, and a second side surface.

The waveguide substrate 1 has a high precision step 5 formed along each side surface of an upper surface thereof, and the hole 13 has a step 15 formed on its top surface, along each side surface thereof, so as to fit the high precision steps 5 when the waveguide substrate 1 is inserted in the hole 13. Consequently, the waveguide substrate 1 can be easily and accurately positioned and fixed in the hole 13.

Because the hole 13 passes through the end member 2, as distinguished from into the end member, the waveguide substrate 1 is fixed more accurately and more securely to the end member 2.

In another exemplary embodiment of the invention, a cavity 14 opens from the bottom surface of the hole 13 to the bottom surface of the end member 2. As brought out at page 11, lines 12-17 of the specification, when the waveguide substrate 1 is positioned in the hole 13, the substrate 1 can be pressed toward the top surface of hole 13 to accurately align the steps 5 on the substrate with the steps 15 on the top surface of the hole. The substrate 1 can be fixed in this position with an epoxy glue.

THE PRIOR ART REFERENCES

The Henson Reference

Henson discloses a fiber optic edge card connector for coupling optical fibers 24 to optoelectronic devices 48 and 50 on circuit card 18. The connector comprises a housing 12 supported by a substrate 18 such as a circuit card, a mounting frame 14, and a plug 16. A cavity is formed in the upper surface of mounting frame 14, and notches 34 (unnumbered in Figure 1, but described at column 3, line 52) in the side surfaces of the cavity cooperate with

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splines 36 on plug 16 to form a tongue and groove arrangement, allowing plug 16 to slide into mounting frame 14. Ferrules 42 on plug 16 can then be mated with ferrules 54 on housing 12 through sleeves 46.

The Kropp Reference

Kropp discloses a component module that includes a substrate 1 having a top side on which both a plurality of optical waveguides 4 and first positioning structures 12, 13 are created by planar structuring. Joined to the substrate is a plug connector part 20, which has a cavity in its bottom surface, facing the top side of substrate 1. Second positioning structures 27, 28 are provided in the cavity upper surface to cooperate with the first positioning structures in positioning the substrate within the cavity.

The Bruce Reference

Bruce discloses a process for fabricating a silica-based optical device on a silicon substrate. The device has a cladding formed in a silicon substrate. The device also has an active region, and that active region is formed on the cladding. The cladding is fabricated by forming a region of porous silicon in the silicon substrate. The porous silicon is then oxidized and densified. After densification, the active region of the device is formed on the cladding.

The Kawaguchi, et al. Reference

Kawaguchi discloses an optical device which comprises a substrate, an optical waveguide, a laser diode, and photodiodes. An inclined groove or slit 23 is formed in the

upper surface of the device, and a filter 15 is in the slit. The laser diode emits a signal light beam with a first wavelength. The filter transmits the signal light beam with the first wavelength and reflects a signal light beam with a second wavelength. The signal light beam reflected by the filter is received by a photodiode.

ARGUMENT

Arguments As To All The Claims

The waveguide substrate of the claimed invention has a high precision step formed along each side edge of its upper surface, and the connecting end member has a hole through it, with a step formed on the top surface of the hole, along each side surface of the hole, so as to fit the high precision steps on the waveguide substrate when the waveguide substrate is inserted in the hole. As a consequence, the substrate can be positioned and fixed in the end member with high precision.

In contrast, Henson has a cavity formed in the upper surface of mounting frame 14 and notches 34 in the side surfaces of the cavity to cooperate with splines 36 on plug 16 to form a tongue and groove arrangement, allowing plug 16 to slide into mounting frame 14.

Additionally, the Henson reference does not disclose features of the present invention as defined by some of the dependent claims. For example, the invention as defined by claims 15, 16, and 18 provides a self-aligning structure in which, with the substrate inserted into the through hole, steps 5, 5 of the substrate and steps 15, 15 on the top surface of the through hole can be aligned by pressing the substrate toward the top surface of the hole. As a consequence, it is possible to obtain an aligning accuracy of less than 1 μm . Henson only

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discloses a tongue and spline structure for connecting an optical waveguide to an optical component. The connecting structure of Henson does not provide an alignment accuracy of less than 1 μm .

Further, even if a person of ordinary skill in the art were to combine Henson with Kropp, the resulting combination would not lead to the claimed invention. Both Henson and Kropp provide a cavity into which the optical conductors are positioned. This would not lead to the claimed end member or housing member which has a hole that goes through it, with a top surface, a bottom surface, and side surfaces.

Neither Bruce nor Kawaguchi adds that which distinguishes the claimed invention from Henson and Kropp.

None of the references shows or suggests an optical module including a waveguide substrate having high precision steps formed in a longitudinal direction along both side edges of an upper surface of the waveguide substrate, and including an optical fiber connecting end member with a through hole so as to fit the high precision steps on the waveguide substrate when the substrate is inserted in the through hole. None of the references shows or suggests high precision steps on the waveguide substrate or steps in a through hole so as to fit the high precision steps.

It is accordingly submitted that the claims distinguish patentably from the references and are allowable.

Additional Arguments As To Claims 15, 16, and 18

The structures of claims 15, 16, and 18 have a cavity that opens from the bottom

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surface of the hole to the bottom of the end member or housing member. This cavity permits a pressing member to press a substrate toward the top surface of the hole so as to align steps on the substrate with the steps of the hole. None of the references shows or suggests such a cavity.

CONCLUSION

In view of the foregoing, Applicant submits that claims 1-4, 6-7 and 13-18, all the claims presently pending in the application, are patentably distinct over the prior art of record and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper,

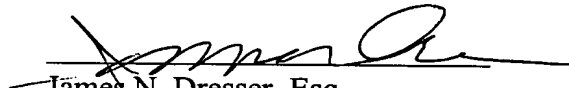
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including extension of time fees, to Attorney's Deposit Account No. 50-0481 and please credit any excess fees to such deposit account.

Respectfully Submitted,

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James N. Dresser, Esq.
Registration No. 22,973

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254